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ABSTRACT

Health care has become a leading growth sector of the economy, and a large part of that growth has its origin in the research generated by faculty in academic health centers. This paper discusses an effective program for translating academic health center research into economic development based upon observations at 12 centers. Topics included are: (1) issues, suggesting major steps of the translation; (2) history of the translation; (3) site visits to the 12 centers; (4) research in the centers; (5) technology transfer; (6) criteria for successful transfer programs; and (7) recommendations for state governments and universities. (YP)

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Health Research = Economic Development

Translating Health Research Findings Into Economic Development

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Southern Regional Education Board

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Translating Health Research Findings Into Economic Development

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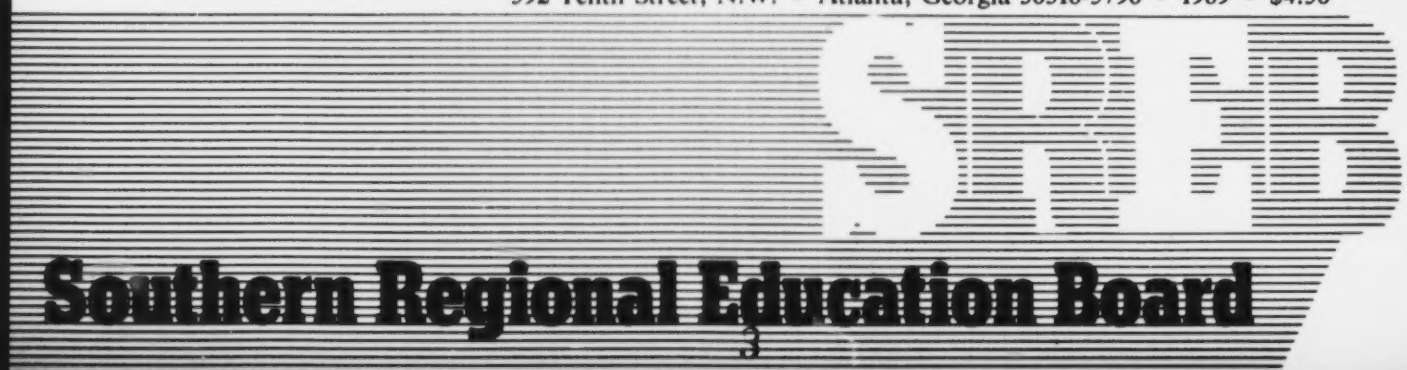

HEALTH RESEARCH = ECONOMIC DEVELOPMENT
Translating Health Research Findings into Economic Development

The health care sector today accounts for well over 10 percent of gross national product; the development and manufacture of drugs and medical equipment is booming; and in many cities, health care institutions rank among the largest employers. Health care financing and new diagnostic and therapeutic technologies regularly occupy front page headlines. Indeed, health care has become a leading growth sector of the economy, and a large part of that growth has its origins in the research generated by faculty in academic health centers.

The full economic potential of health-related research became apparent to some of the major academic health centers with dynamic breakthroughs in biotechnology just a decade ago. Martin Kenney, in Biotechnology: The University-Industrial Complex (Yale University Press, New Haven, CT, 1986), documents the research and product development activities of four universities in the study of recombinant DNA. Harvard University, Stanford University, the University of California, and the Massachusetts Institute of Technology have collaborated with multinational corporations and start-up companies in the production of new products based on this DNA research that have enriched both the universities and the investigators.

Biotechnology represents a special case that not every academic health center can or should match. There are many other areas of biomedical research, however, that promise opportunities for university/industry collaboration and economic benefits for researchers, universities, and local communities. Academic health centers are interested in such relationships because they can provide increased funding for their research activities at a time when funding from foundations and the federal government seems to have peaked. They also see collaborative relationships as a way to keep outstanding researchers on campus rather than having them lured away to industry by higher salaries.

The potential for translating the research activities of academic health centers into economic development has only recently begun to be recognized. Many of these health centers are developing their own technology transfer programs or affiliating with existing ones. Unlike universities, the academic health centers do not have the benefit of faculties with direct experience and credentials in business and entrepreneurship. Support from state and university leaders is required if academic health centers are to translate their unique research strengths into economic benefits.

Much of the research conducted in academic health centers is basic research that has limited immediate practical application. However, an increasing number of research

findings do result in discoveries that have potential for commercial application. To develop these research findings into commercial products requires an extensive process that involves obtaining patents and licensing the discoveries to existing companies or financing and organizing new companies to manufacture and market the products.

Most researchers and most public universities are not oriented to pursuing the "business" activities required for product development. Too often, those researchers who are interested in pursuing commercial development of their findings must leave their research laboratories to become business entrepreneurs. The situation becomes especially complicated for both investigators and universities when commercial firms offer support to faculty for specific research but insist on restrictions regarding the secrecy of findings or other restraints that may conflict with the traditional ethics of academia.

Issues in Turning Health Research into Products, Jobs, and Dollars

Translating university research into the industrial development of a state or region involves three major phases.

1) Investigation of an original idea and description of the resulting inventions or discoveries;

2) Development of these inventions or discoveries so that they are "market ready" for commercialization;

3) Licensing of those products for production and marketing to a company that can be persuaded to locate its facilities in the state in which the research was done or, if that is not feasible, creating a new company to produce and sell the product.

Traditionally, universities have assumed responsibility for only the first of these phases. Researchers in academic health centers shunned contracts with commercial sponsors that might have increased their research activities on the grounds that for-profit contracts somehow "tainted" the research and required unacceptable ethical compromises. They looked instead to grant funding from foundations or federal agencies to support their research.

State-level technology transfer programs have sought to change this. Because they have tended to focus on engineering and electronics research, however, they have not always been well suited to the biomedical research field, which has some unique characteristics.

Nearly all biomedical research, especially at the clinical (applied) level, operates under the rules and constraints of the U.S. Food and Drug Administration, which has strict requirements for the effectiveness and safety of medications and medical devices. These requirements often delay the move from animal and toxicity studies to clinical studies with

real patients, thus prolonging the time required to bring discoveries to market. The average five to seven years required to bring biomedical discoveries to market calls for a considerable financial commitment from investors.

Competition in the biomedical products field is also greater than in many other product areas and is broader, requiring international patents and licenses. Biomedical industries are anxious to use the expertise of university investigators, but they are also inclined to demand secrecy and exclusivity in exchange for their financial commitments. (There is growing concern that firms in Western Europe and Japan are gearing up to "buy out" the expertise of American researchers and then "sell back" these products in the United States.)

Eight distinct steps must be negotiated to translate biomedical research into salable products that can be manufactured and marketed in local communities.

1) Ideas, which may come from faculty researchers, clinical practitioners, or representatives of biomedical products companies, must be formulated as hypotheses that can be tested and evaluated. The ideas and recommendations for testing them must then be written in the form of proposals for funding that can be evaluated by reviewers from federal agencies, foundations, or biomedical products companies.

2) Applications for research grants or contract proposals must be submitted for review and negotiation before approval. In the competitive grants review process of the federal government and many foundations, only about one-third of original applications are approved. Contracts with proprietary companies are often negotiated more quickly, but they usually require that the investigators have established track records of research achievement and on-time performance.

3) When funding has been obtained, the research must be conducted according to protocols defined in the grant applications or contract proposals. Firm policies must be established to minimize conflicts between traditional academic requirements for publication and commercial demands for secrecy. For example, faculty cannot be expected to embrace technology transfer efforts if the resulting time required for commercialization has a negative impact on university tenure and promotion decisions.

4) A patents committee or other similar group must evaluate the findings of investigators to determine their possible commercial applications. This review group should include persons familiar with the biomedical market. Since faculty often fail to appreciate the possible commercial applications of their discoveries, especially when they are of the low-tech variety. Real-life examples of profitable low-tech products include a modesty shield for use during mammography and a surgical suction device with less tendency to clog. Conversely, researchers may overvalue technically elegant discoveries that have only limited commercial potential. In addition, findings may point to possible commercial applications that have not been specifically demonstrated in the particular research study. In such cases, investigators should be encouraged to design new studies to demonstrate the commercial applications of the findings.

5) When discoveries are judged to have product potential, patents must be obtained by either the universities, the investigators, research foundations, or proprietary companies. Since patents are expensive, there must be agreement ahead of time regarding who is to obtain the patent. Patents must address both national and international implications of any marketable discovery. In general, outside patent law firms should be retained, since university counsels rarely have the needed expertise in this area.

6) Further studies are usually necessary to develop prototype models, conduct market feasibility studies, or otherwise prepare to demonstrate market potential of the proposed products. Funding for these intermediate developmental studies and activities is often the most difficult to obtain.

7) The products must then be licensed to existing or newly created companies for production and marketing. If the products are to be licensed to existing companies, there must be agreements regarding royalties to be received by the universities and the investigators. If new companies are to be formed, the agreements will focus on the roles of the investigators and the university in the new companies and on arrangements for holding stock options, consultation contracts, joint appointments, etc. Universities must have clearly established intellectual properties policies for these kinds of arrangements.

8) If there is a likelihood that new companies or new production facilities for existing companies may be located in the state or community, there must be negotiations with local economic development officials, industrial parks, research parks, industrial incubators (facilities that provide technical assistance and common support services to new and developing companies), venture capitalists, and others. These development steps require expertise in the fields of business planning and administration and biomedical marketing, as well as knowledge of venture capital in the health field. The academic health centers need mechanisms to provide this support, since few academic researchers have expertise or interest in these matters.

Beginnings of Technology Transfer in Academic Health Centers

The first academic health centers to move into commercial research ventures were private universities. Most already had large research commitments funded by foundations and federal agencies and, as private institutions, they had the flexibility to negotiate private for-profit contracts. They initiated some research funding from pharmaceutical firms and found that they could use those funds without compromising their scientific integrity. However, they also learned that they needed firm policies and procedures for those relationships so that the interests of both the universities and the investigators were protected while the research was underway and later when the resulting products were put on the market. From those early explorations came decisions to set up formal structures to promote the development of university/industry relationships. The idea was to improve the academic health centers' revenues for research and to enable the

universities to keep productive investigators on their faculties who could continue their research studies while also enjoying some of the profits of their creativity.

Early technology transfer programs were funded almost entirely from university resources and were aimed at generating revenues for the academic health centers and their staffs, not to stimulating the local economies. In fact, discoveries from these programs were most often licensed to firms that were already in a position to produce and market the products at existing production facilities, wherever they might be located. Although there was a recognition that new firms created by faculty investigators with strong entrepreneurial inclinations would probably be located close to the academic health centers, there was no particular expectation that such firms would be considered part of local economic development programs.

The success of some of the early technology transfer programs in private universities encouraged a number of public academic health centers to establish similar programs to facilitate research and development. The public institutions have had to move cautiously because of constraints in purchasing and personnel policies and a concern that substantial revenues from private sector relationships would be perceived as being in conflict with the public interest.

The SREB Study of Technology Transfer in Academic Health Centers

In June 1987, staff of the SREB health program surveyed the formally designated academic health centers in SREB member states to learn more about existing or proposed programs to encourage economic development through research or service activities. The report of that survey, "Economic Development Approaches of Academic Health Centers in the South" (September 1987), described a surprising array of programs to stimulate research and technology transfer. Nearly all of these had been created since 1984 and were struggling with a variety of problems because they were new and because there was little experience in similar programs to draw on. Several additional academic health centers were being urged by their parent universities or local industrial promoters to become more involved in technology transfer.

The Southern Regional Education Board's Executive Committee suggested that it would be helpful to other states and academic health centers to explore the issues more extensively through site visits to several of the responding academic health centers.

The academic health centers responding to the 1987 survey varied widely. They included both private and public, rural and urban institutions. There were dramatic differences among institutions in terms of their research emphasis and the extent of their

experience in technology transfer. They also varied in terms of where the impetus to develop technology transfer initiatives was coming from—whether from within the center itself, from the parent university or state program, or from local economic development programs.

To gain a more complete understanding of the effects of these differing institutional frameworks, site visits were made to 12 academic health centers representing a mixture of these characteristics.*

Private Institutions:

Baylor College of Medicine, Houston, Texas
Bowman Gray School of Medicine, Winston-Salem, North Carolina
Emory University, Atlanta, Georgia
Medical College of Hampton Roads, Norfolk, Virginia

Public Institutions:

University of Alabama at Birmingham
East Carolina School of Medicine, Greenville, North Carolina
University of Kentucky, Lexington
University of Maryland at Baltimore
University of Mississippi Medical Center, Jackson
University of Texas Health Science Center at Houston
University of Texas Health Science Center at San Antonio
University of Virginia, Charlottesville

The purpose of the site visits was to determine how the technology transfer programs had been developed, what activities were being pursued, what results achieved, problems encountered, solutions recommended, and, especially, what suggestions could be made to facilitate the development of similar programs to bring economic benefits for the local communities and home states of other institutions.

The persons interviewed included university presidents and chief academic or health officers; deans of professional and graduate schools; development officers; directors of technology transfer programs; heads of both basic science and clinical departments; individual investigators; presidents of newly created biomedical technology companies;

* Details of each site visit are in the SREB publication, "Case Studies in Translating Health Research into Economic Development."

directors of industrial incubators and industrial parks; and economic development officials of local governments and chambers of commerce. Efforts also were made to contact key persons in state government and state-level technology transfer programs to learn their perceptions of how to facilitate technology transfer in the biomedical field.

The visits to the academic health centers revealed that there are amazing amounts and varieties of biomedical research activity underway in the SREB states. Many of the research findings promise to dramatically change and improve the health care delivery system of the nation. Some of these research activities include: high-tech explorations in immunology, genetics, neurobiology, and pharmacology; development of new applications of biological materials; bio-communications systems; and lasers and other devices to explore and alter the internal structures of the body without invasive surgery. A host of less dramatic, but nevertheless very practical, tools also are being developed to improve diagnosis and treatment of illness and to facilitate rehabilitation. While much of this biomedical research has implications for economic development, several issues must be addressed before the region will see significant economic benefits.

Commitment to Research in Academic Health Centers

Every school conducts some research. All of the private academic health centers visited and a few of the public centers make substantial commitments to research, with research budgets from all sources ranging from $25 million to $100 million per year per center. In many of the region's academic health centers, however, especially the public institutions that were created specifically to prepare primary care practitioners, there is relatively little research funding or activity. Often, what research is carried out in these institutions involves a small number of faculty in a few departments and is motivated by their personal interests, not because the school strongly expects or assists faculty research. In this type of institution, faculty have usually been selected for their teaching abilities and interests rather than for their expertise in research design and methodology. In addition, there is likely to be little space devoted to research laboratories and little funding for research technicians or other support staff.

Most major breakthroughs in biotechnology and biomedical products development have occurred in California and the Northeast, where a few medical centers have long had major commitments and substantial funding for research. While there are some dramatic exceptions in the SREB states, the region's academic health centers as a group accounted for only 17 percent of the research and development contracts awarded by the National Institutes of Health (NIH) in 1986, even though the region accounts for one-third of the nation's medical

schools. Only four of the region's schools--Johns Hopkins University, Duke University, Baylor College of Medicine, and the University of North Carolina at Chapel Hill--were among the top 20 recipients of extramural research grants from the NIH in 1986; of these, only Johns Hopkins was among the top 10.

Research Advancement and Technology Transfer Programs

Among the academic health centers visited, a wide variety of administrative units and procedures are in place to encourage research and the transfer of findings into commercial products. A common pattern involves two related units, one to encourage and stimulate research and another to address the development of new companies or the location of established biomedical products companies in the community and state. Baylor College of Medicine, for example, has a well-developed Office of Technology Assessment to encourage research and recruit industry sponsorship. A separate but related corporation, BCM Technologies, Inc., speeds development of new companies and transfer of potential products into commercial production.

The means to stimulate research generally include either offices of research within the academic health centers or separately incorporated research foundations, which may operate at the overall university level. The advantage of separate foundations is that their activities are not limited by university rules and regulations. Technology transfer structures for local economic development are most likely to be not-for-profit corporations (although in some places they are for-profit organizations). The division of responsibilities varies, and in many of the centers procedures are still under development.

In most cases, the initial funding for technology transfer activities has come from university resources. However, it is anticipated that the resulting structures will become self-sustaining through contract fees, royalties, and stock options from new companies. Unfortunately, funds are often inadequate to do all of the promotional work and research recruiting necessary to reach a self-supporting level.

Perhaps the most critical stage in the technology transfer process involves the developmental studies necessary to make inventions with commercial potential market-ready. This phase is often left to individual investigators, many of whom are neither interested nor adept in pursuing the commercial development of their inventions. Others are overwhelmed by the difficulties of designing the required market studies or obtaining the funding and expertise to carry them out. In other cases, investigators are unsuccessful in obtaining funds to demonstrate commercial potential and, as a result, the ideas never reach the marketplace.

Research advancement and technology transfer structures can play key roles in helping to obtain funding and providing expertise for the design of such intermediate studies and in contacting companies that are potential licensees. While some private firms may be willing to provide funding and technical assistance at this stage, they may demand in return that researchers and the universities settle for lower royalties, so it is to the advantage of the researchers and the universities to be able to manage this stage independently.

Those academic health centers with relatively small research commitments generally do not have separate technology transfer units. In such cases, the few faculty who do have significant research interests often have established private contracts with specific companies for sponsored research. Such individual relationships are unlikely to be linked with local or state economic development activities.

Criteria for Successful Health Technology Transfer Programs

Based upon observations at the 12 academic health centers, the following elements appear to be directly relevant to successful technology transfer programs in academic health centers:

1) Strong and visible commitments by the centers' leaders to research and the transfer of findings into commercial products whenever feasible;

2) Firm sets of policies and procedures related to intellectual properties, industry-sponsored research, and technology transfer;

3) Staffed structures within the centers for encouraging and expediting research, including research sponsored by private firms, and the authority to expedite movement of research contracts and technology transfer activities through the bureaucracy of the university;

4) Faculty and staff with expertise in grantsmanship and basic and applied research methodology;

5) Strong patents committees that include members with expertise in both biomedical markets and in research;

6) Resources for conducting intermediate studies to document that inventions are market-ready;

7) Structured corporations for creating new businesses to produce and market both high- and low-tech biomedical products that result from faculty research;

8) Resources for these corporations to aggressively pursue the location of new biomedical products companies and the relocation of established companies within the local communities and states;

9) Resources, such as industrial incubators, developmental funds, and tax credits, to assist newly created and existing companies to become established within the state.

Recommendations for State Governments

- **STATE GOVERNMENTS SHOULD MAKE LONG-TERM, STABLE COMMITMENTS TO ASSIST PUBLIC AND PRIVATE UNIVERSITIES IN BIOMEDICAL TECHNOLOGY TRANSFER.**

State governors and legislators are becoming increasingly aware of the potential to improve the state economies by assisting universities to translate research findings into commercial products. This new mission for the universities requires long-term support to succeed. North Carolina's Research Triangle Park, for example, received the unflagging support of a succession of governors and legislators for over 20 years before becoming fully successful.

- **STATES SHOULD MAKE FUNDS AVAILABLE TO STRENGTHEN THE BIOMEDICAL RESEARCH CAPABILITIES OF ACADEMIC HEALTH CENTERS.**

A number of steps are needed to strengthen biomedical research capabilities. Providing funds for endowed research professorships can help build a stable research faculty in an area too often subject to the vagaries of "soft money." Most academic health centers also face shortages of research space and inadequacies in equipment. States can help alleviate these problems by allowing institutions to retain overhead funding included in research grants without loss of other revenues, by recognizing the special needs of research institutions in facilities funding, and by modifying restrictive purchasing requirements as they apply to research equipment. They can help further by providing state-supported grant programs to serve as research "seed money" and by supporting training programs for adequate numbers of basic and clinical researchers in the biomedical sciences.

- **STATES SHOULD MAKE FUNDS AVAILABLE TO PUBLIC AND PRIVATE UNIVERSITIES FOR THE CREATION OF SPECIAL INDUSTRY/UNIVERSITY UNITS TO ENCOURAGE BIOMEDICAL TECHNOLOGY TRANSFER WITH AN EMPHASIS ON STATE ECONOMIC DEVELOPMENT.**

Every academic health center with a significant biomedical research program should have an "office of technology development" or other central point for promoting industry/university relations and technology transfer. In private universities, most of the current funding for technology transfer programs comes from private sources and is only

incidentally related to economic development within the state. Public universities have tended to base their programs on this private model, the only one available. States should provide support to all of their research-oriented academic health centers with the clear expectation that local and state economic development activities should be emphasized. Separate technology transfer units will require financial support for a number of years before the programs can be expected to be self-supporting. Approximately $150,000 per year could be sufficient to provide adequate funding during the start-up period.

- **STATES SHOULD MAKE SMALL GRANTS AVAILABLE TO BIOMEDICAL RESEARCHERS AND NEW BIOMEDICAL COMPANY ENTREPRENEURS TO ASSIST IN COMMERCIAL PRODUCT DEVELOPMENT.**

Some states have established grant programs for the support of biomedical and other research, and this is desirable. However, researchers find two kinds of funds especially difficult to obtain: (1) state grant programs to support intermediate studies to demonstrate the potential market value of a product based on the original discovery; (2) grants to match the federal Small Business Innovation Research Program (SBIR), which is designed to help innovative business entrepreneurs develop their business plans for start-up companies and to do feasibility research. Phase I grants of this program require matching funds up to $50,000.

- **STATE-SUPPORTED PROGRAMS SHOULD INCLUDE ALL UNIVERSITIES THAT HAVE BIOMEDICAL RESEARCH PROGRAMS.**

States sometimes fund special programs only at public universities or at certain flagship institutions. Creative ideas and research technology are not the exclusive claim of any single university, however, and some of the more practical innovations with significant potential for improving the lives of large numbers of persons will come from the clinical faculty of schools with primary care missions. Each academic health center is likely to have its own areas of special research expertise that can be developed independently to the overall benefit of the state's economy.

- **STATES SHOULD BE PREPARED FOR THE LIKELIHOOD THAT NEW BIOMEDICAL PRODUCTS COMPANIES WILL WISH TO LOCATE IN AREAS CLOSE TO ACADEMIC HEALTH CENTERS.**

Most new companies that develop from biomedical research will want to locate in close proximity to the academic health center. This will be especially true if a research park is being developed close to the academic health center so that there can be frequent interactions between faculty researchers and company scientists. Otherwise, new companies

may want to locate production facilities in nearby industrial parks or communities. Companies created to produce low-tech products that are not so dependent on frequent contact with university researchers may be more inclined to locate in outlying areas where there may be favorable labor markets or other advantages. It is not necessary that every state should attempt to create a biomedical research park or a biotechnology incubator, but all states should make efforts to assist such companies in finding locations that are advantageous to all parties concerned.

- **STATES SHOULD MAKE CHANGES IN STATE LAWS THAT IMPEDE TECHNOLOGY TRANSFER PROGRAMS.**

States may wish to exempt universities from state purchasing and personnel restrictions that slow down or inhibit research and development, such as central purchasing requirements for research equipment or the necessity for competitive sealed bids. States may consider exempting faculty members from conflict of interest laws that forbid persons employed by public agencies from owning more than a small portion of any company that does business with the state. Such laws often make it impossible for faculty researchers to be part owners of the companies created from their research. States also may wish to provide special tax credits for new companies that develop from technology transfer activities. This option should be made available for any new biomedical product company, whether developed from a university-based research program or from some other technology entrepreneur.

Recommendations for Universities

- **ESTABLISH FULL-TIME, ADEQUATELY STAFFED STRUCTURES TO PROMOTE UNIVERSITY/ INDUSTRY RESEARCH COLLABORATION AND TECHNOLOGY TRANSFER.**

Whether designed as a single integrated unit or as separate and complementary, offices of research development and technology transfer and/or research foundations can play a pivotal role in translating research discoveries into economic benefits for the researcher, the university, the local community, and the state. The activities of these structures focus on providing technical expertise and moral support. They must have the breadth of expertise and the flexibility to deal with problems at every point in the technology transfer process where good ideas may become stalled. This requires expertise in obtaining funding (both for basic research and product development studies), in patent law, in health product marketing, in public relations, and in contract negotiation. This diverse range of highly specialized skills is not likely to be found in a single individual. An office of technology transfer should be staffed with four or five persons. Such an office will probably take five years to generate sufficient income to become self-supporting.

- **MEMBERS OF UNIVERSITY BOARDS, PRESIDENTS, CHIEF ACADEMIC OR HEALTH OFFICERS, AND DEANS MUST HAVE A HIGH LEVEL OF COMMITMENT TO TECHNOLOGY TRANSFER.**

University officials often serve on the boards of local chambers of commerce or local economic development authorities. They must be involved, committed, and aggressive in boosting their institutions' technology transfer activities.

- **UNIVERSITIES MUST HAVE FIRM POLICIES REGARDING INTELLECTUAL PROPERTIES AND TECHNOLOGY TRANSFER PROCEDURES AND ACTIVE MECHANISMS FOR IMPLEMENTING THEM.**

Most universities have some kind of policy on patents, but the complex areas of research contracts and active technology transfer programs require especially strong policies and clear guidelines. It is also important to have some active means, possibly through the patents committee, to continually review faculty discoveries for their commercial potential.

- **UNIVERSITY AND ACADEMIC HEALTH CENTER OFFICIALS SHOULD THINK IN TERMS OF PROMOTING "LOW-TECH" DISCOVERIES AS WELL AS HIGH-TECH ADVANCES.**

The tendency in discussing technology transfer is to think primarily of major high-tech breakthroughs, such as those in biotechnology and genetic engineering. There will surely be more major successes of that kind, and they must be pursued, but many of these "glamor" discoveries have less market potential than more mundane ones. Clinical professors often identify needs of this kind and fashion applications of existing technologies. Such innovations may have wide commercial appeal and greater potential for being produced and marketed from a nearby community than would high-tech products. Clinical professors must be encouraged and assisted to do this kind of research.

- **UNIVERSITIES MUST FACILITATE, ENCOURAGE, AND ABOVE ALL, REWARD RESEARCHERS WHO ARE INVOLVED IN BIOMEDICAL RESEARCH WITH COMMERCIAL APPLICATIONS.**

University officials must make it clear that collaboration with the for-profit sector does not "taint" a faculty person, and should provide encouragement, rewards, and support that demonstrate their commitment to making such arrangements both academically sound and mutually profitable. Further, it is essential that technology transfer offices be staffed with persons who have a healthy "can do" philosophy. The offices should be charged

with expediting research and technology transfer activities even if this means cutting through the university's bureaucracy to assure that decisions are made and documents processed without delay. Endless requirements for reviews and delays in clearance of proposals by officials who are busy with other duties will only make the faculty cynical and discourage proprietary companies.

- UNIVERSITIES SHOULD ENCOURAGE COLLABORATION IN RESEARCH ACTIVITIES BETWEEN THEIR FACULTIES AND THOSE OF NEARBY UNIVERSITIES.

Collaborative studies between researchers at different types of schools often result in commercial products. This is especially likely in the fields of medical devices and materials science, but there are many other possibilities. Universities would do well to encourage and establish formal guidelines for collaborative research arrangements between different schools in the area, both public and private.

Conclusion

Many factors come into play in the development of effective programs for translating faculty research into economic development, regardless of the disciplines involved. Ultimately, the success of such efforts depends upon the quality of the research that faculty produce. Every discipline has its own unique characteristics and needs.

In medicine and health care, the critical need is for expertise in business and law, expertise that academic health centers cannot be expected to possess as a matter of course. Academic health center administrators can promote technology transfer most effectively by providing separate administrative units dedicated first to helping faculty recognize the economic potential of their research and then to helping them realize that potential.

States can help their academic health centers, and ultimately their faculties and their economies, by providing the relatively limited financial support required to establish a distinct technology transfer unit. In doing so, they must also recognize that the benefits will not accrue overnight. Stable funding will be required for a reasonable number of years before a technology transfer unit can be expected to be self-supporting.

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